Soil moisture monitoring for flood and drought early warning in the Midwest

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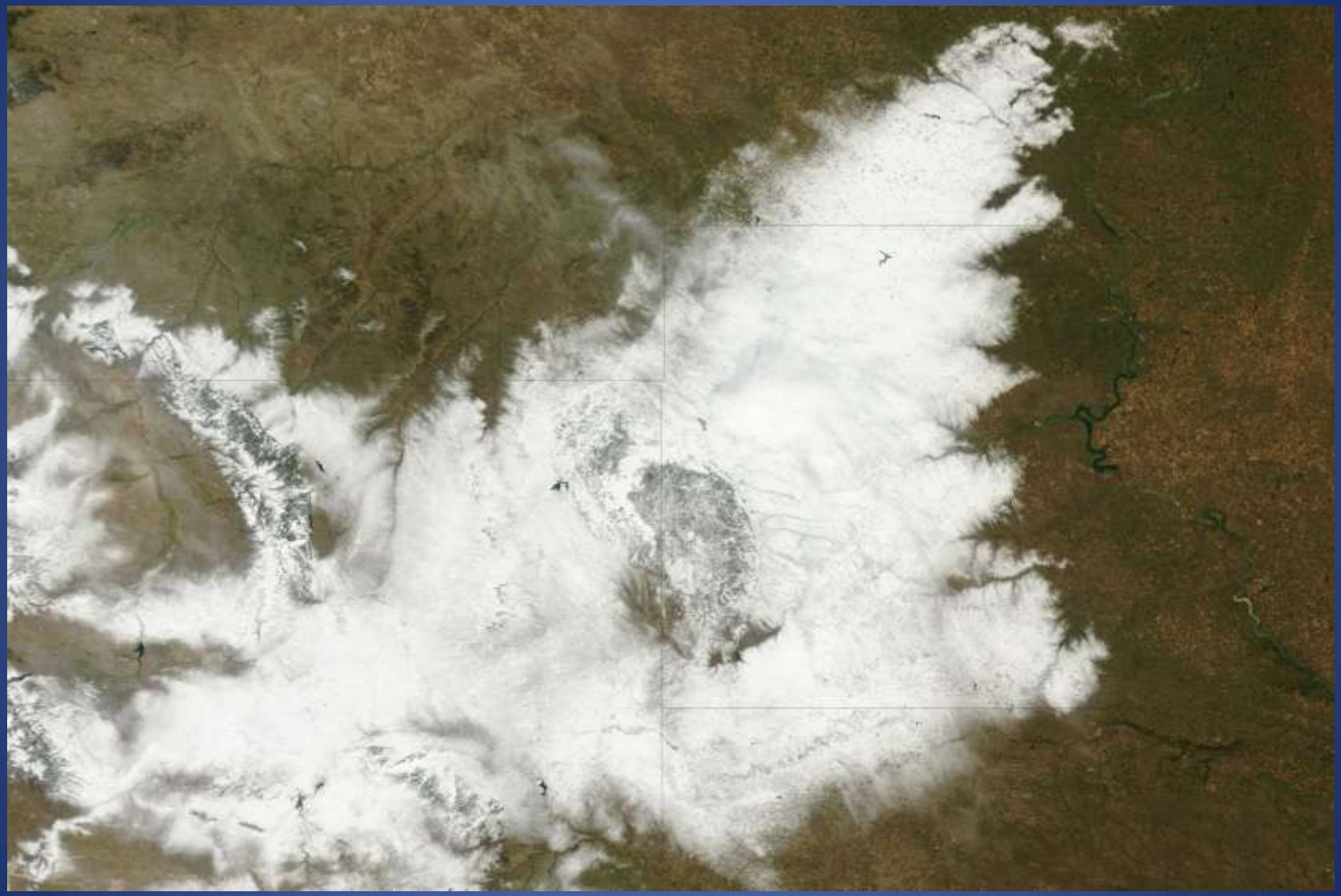
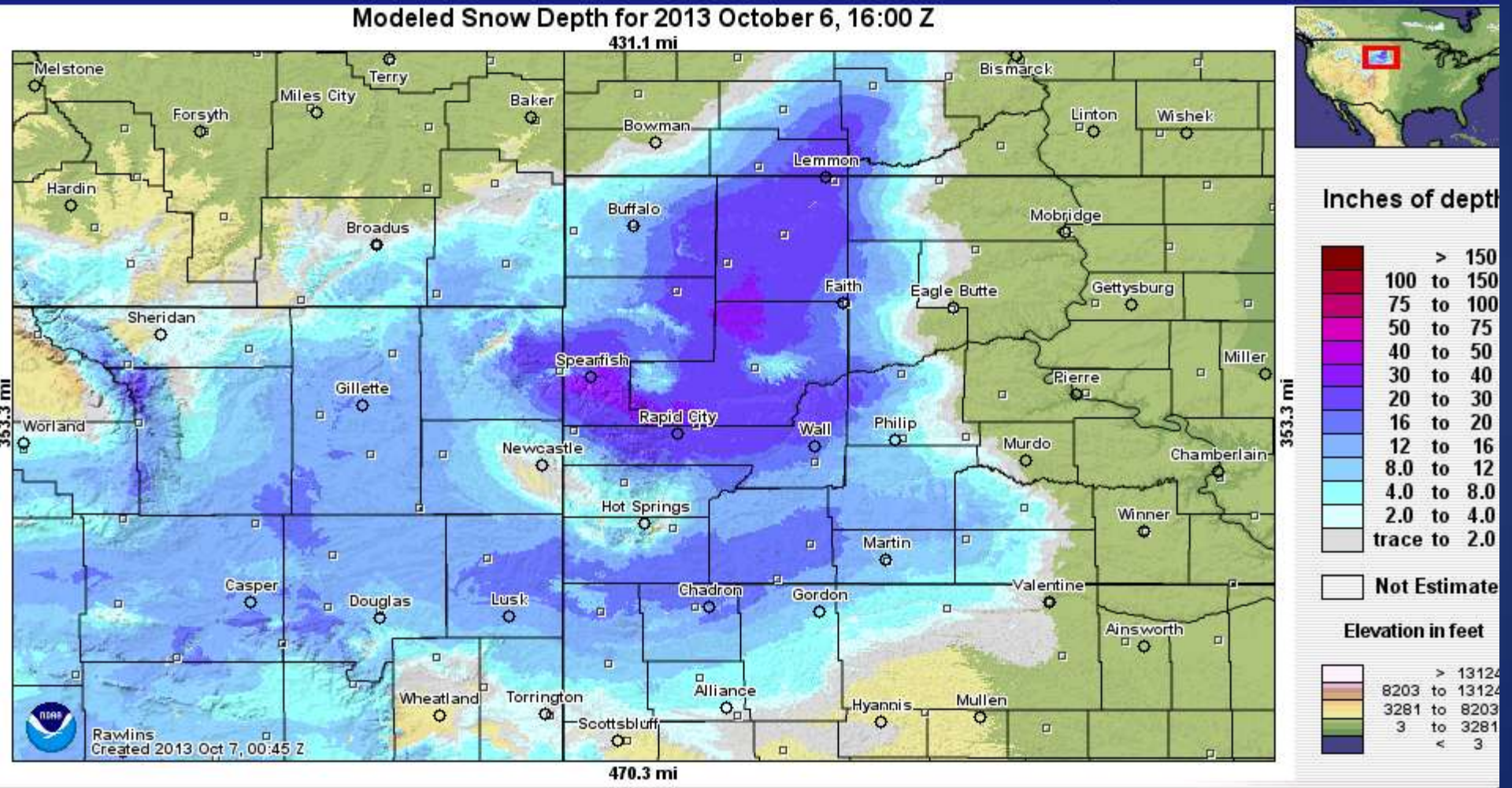
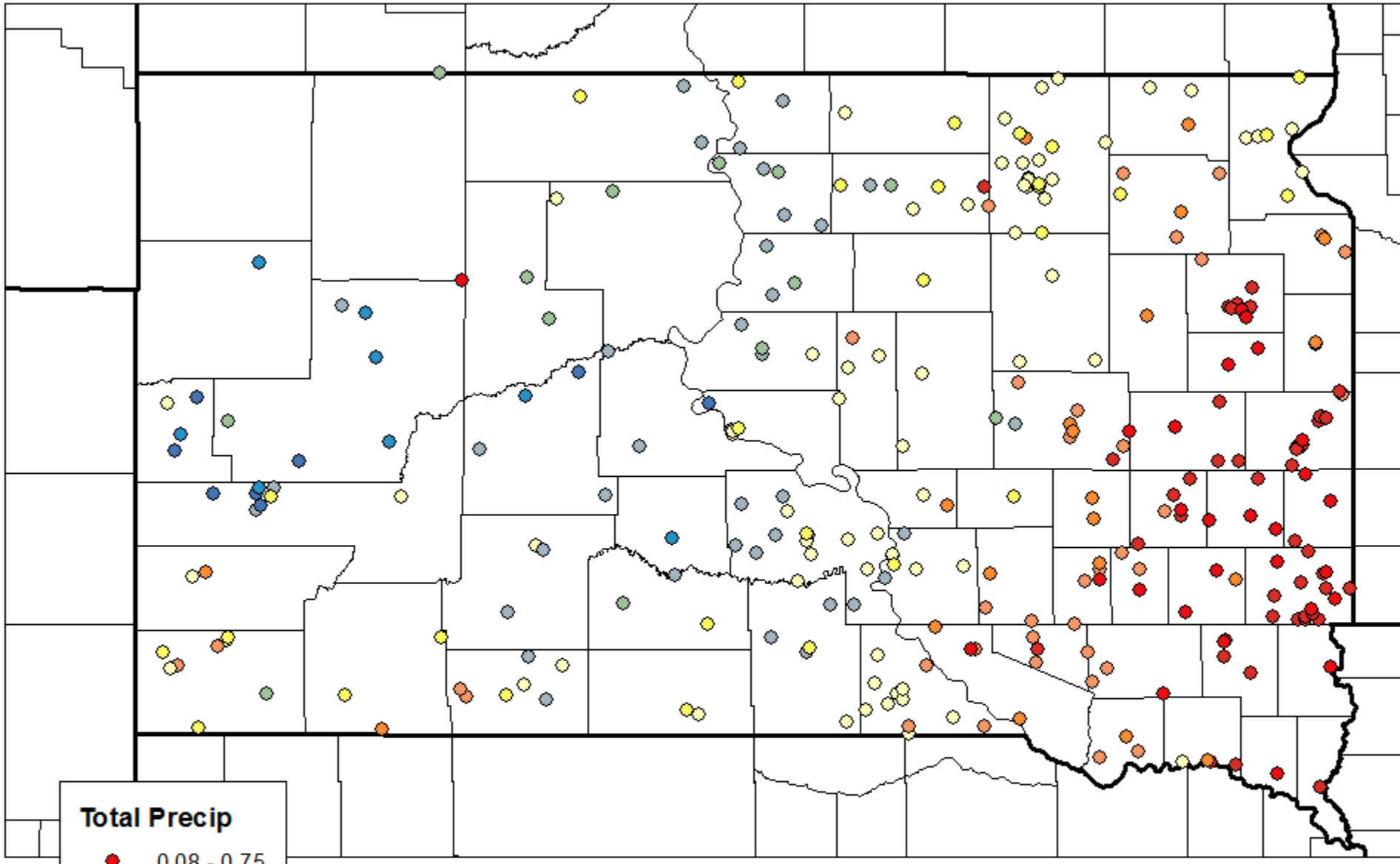
CES/AES/ABE



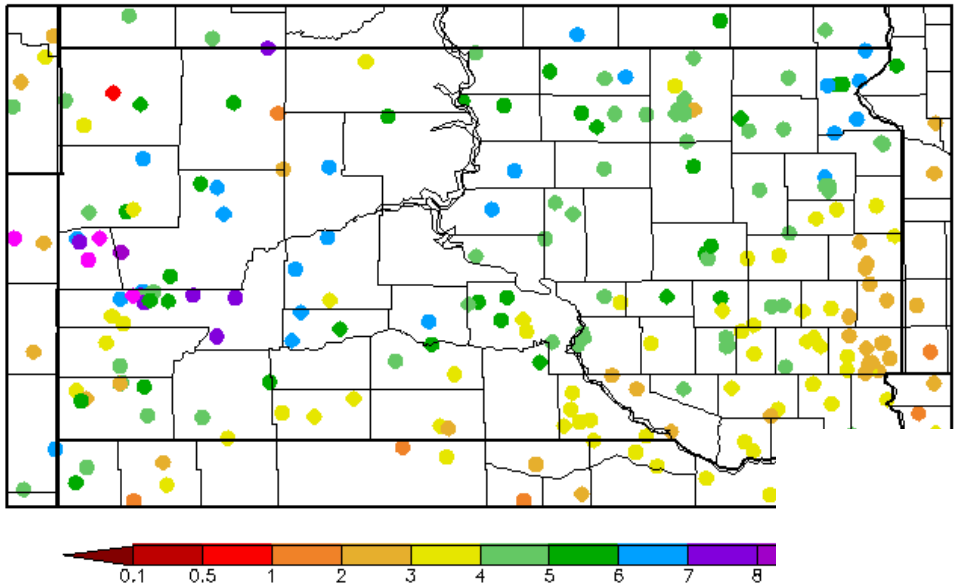

Modeled Snow Depth for 2013 October 6, 16:00 Z
431.1 mi
353.3 mi
353.3 mi
470.3 mi
Melstone
Terry
Miles City
Forsyth
Baker
Bismarck
Bowman
Linton
Wishek
Lemmon
Hardin
Buffalo
Mobridge
Broadus
Faith
Eagle Butte
Gettysburg
Sheridan
Spearfish
Miller
Gillette
Pierre
Rapid City
Wall
Philip
Worland
Newcastle
Murdo
Chamberlain
Hot Springs
Winner
Martin
Casper
Douglas
Lusk
Chadron
Gordon
Valentine
Ainsworth
Wheatland
Torrington
Alliance
Hyannis
Mullen
Scottsbluff
Rawlins
Created 2013 Oct 7, 00:45 Z
Inches of depth
> 150
100 to 150
75 to 100
50 to 75
40 to 50
30 to 40
20 to 30
16 to 20
12 to 16
8.0 to 12
4.0 to 8.0
2.0 to 4.0
trace to 2.0
Not Estimate
Elevation in feet
> 13124
8203 to 13124
3281 to 8203
3 to 3281
< 3

Not spring 2011 – fall of 2013!

SD Storm Total Precipitation October 4-6, 2013



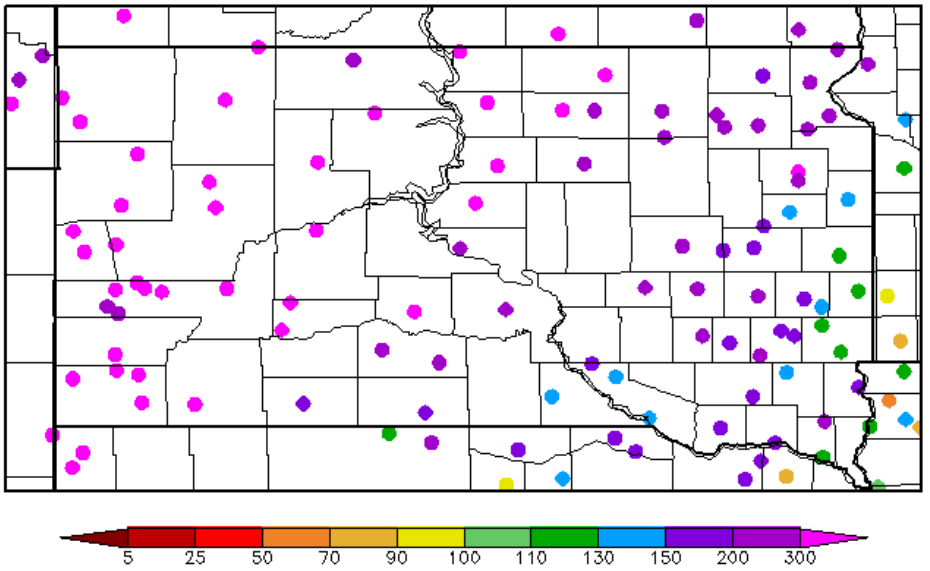
Precipitation (in)
9/29/2013 – 10/28/2013



Generated 10/29/2013 at HPRCC using provisional data.

R

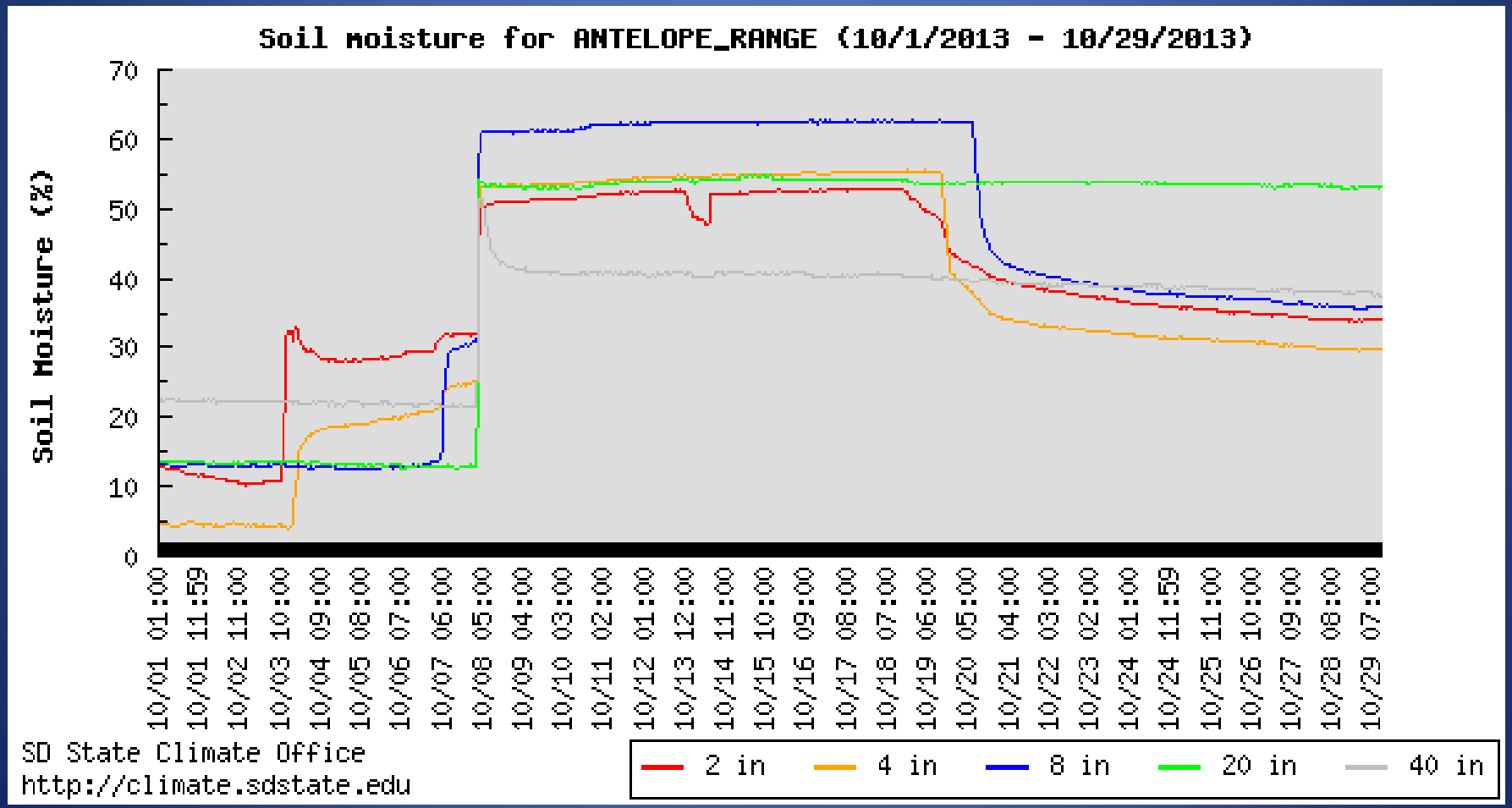
Percent of Normal Precipitation (%)
9/29/2013 – 10/28/2013

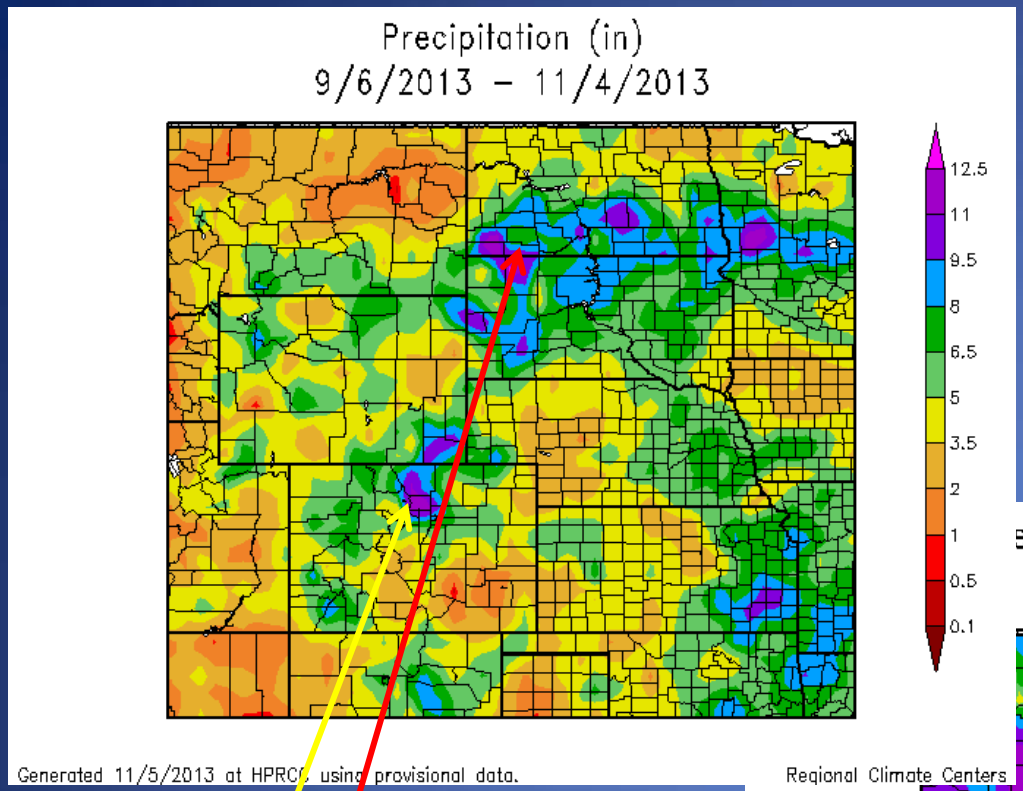


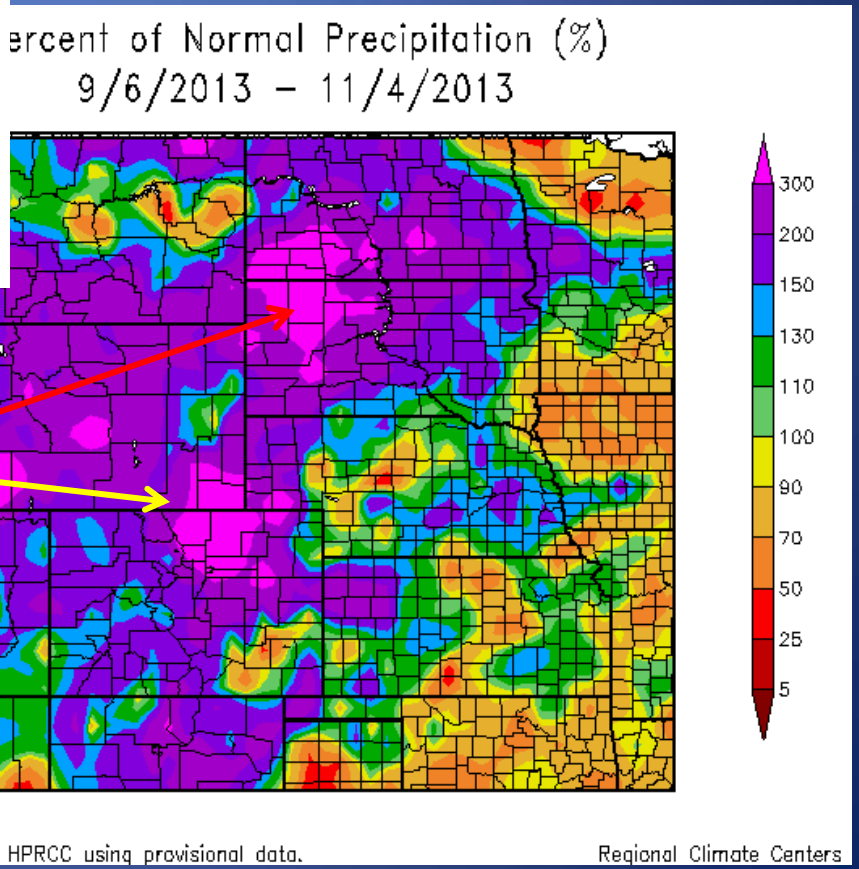
Generated 10/29/2013 at HPRCC using provisional data.

Regional Climate Centers

- What does this really mean for what is going on in the soil – now and in the spring?


Soil moisture for ANTELOPE_RANGE (10/1/2013 - 10/29/2013)
Soil Moisture (%)
70
60
50
40
30
20
10
0
10/01 01:00
10/01 11:59
10/02 11:00
10/03 10:00
10/04 09:00
10/05 08:00
10/06 07:00
10/07 06:00
10/08 05:00
10/09 04:00
10/10 03:00
10/11 02:00
10/12 01:00
10/13 12:00
10/14 11:00
10/15 10:00
10/16 09:00
10/17 08:00
10/18 07:00
10/19 06:00
10/20 05:00
10/21 04:00
10/22 03:00
10/23 02:00
10/24 01:00
10/24 11:59
10/25 11:00
10/26 10:00
10/27 09:00
10/28 08:00
10/29 07:00
SD State Climate Office
http://climate.sdstate.edu
2 in
4 in
8 in
20 in
40 in

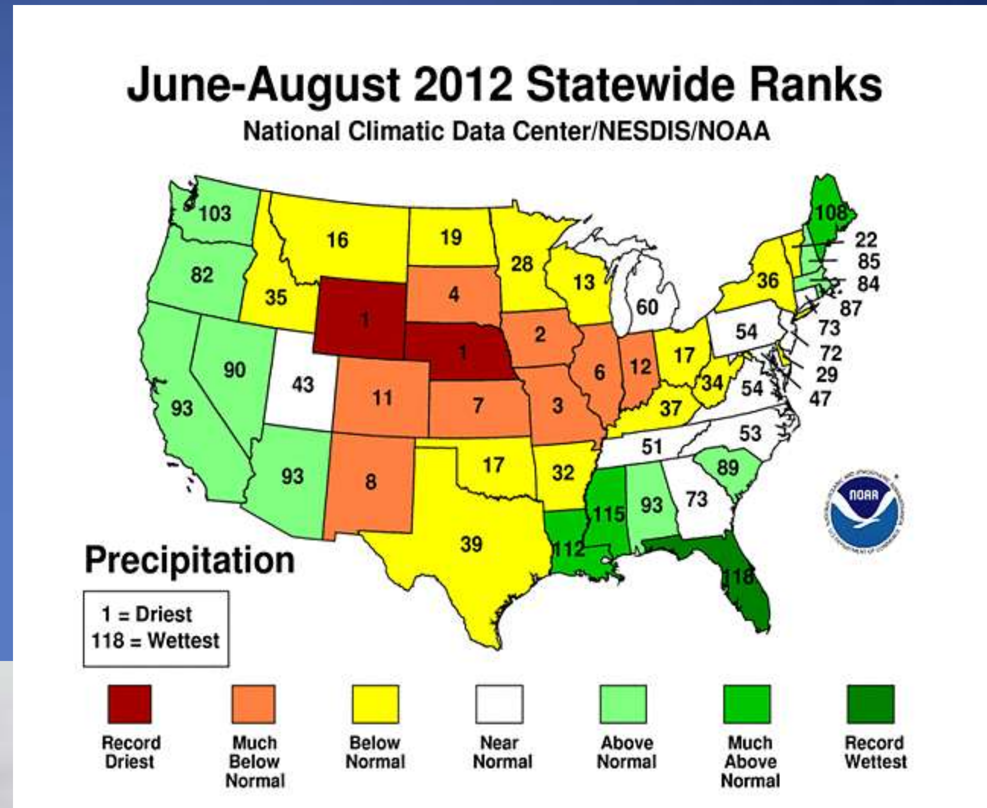


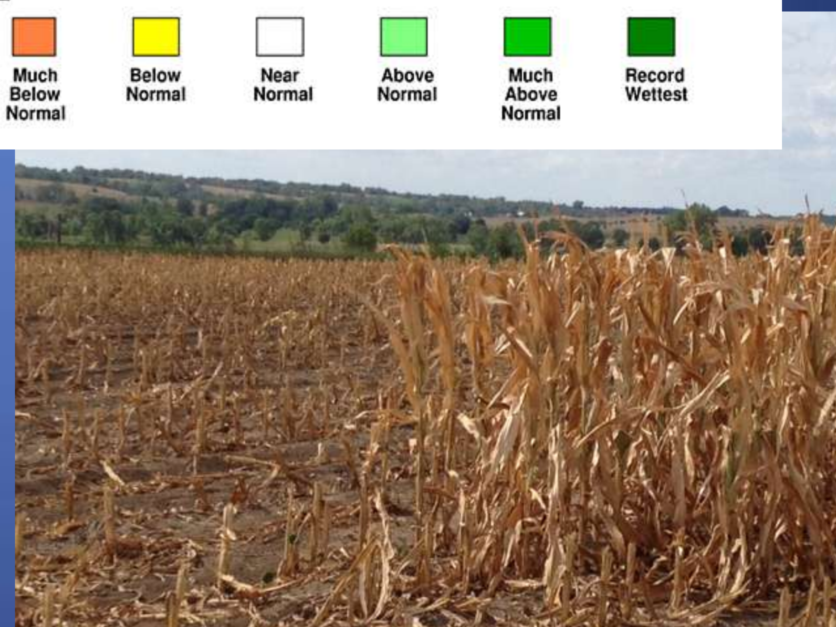


September rains

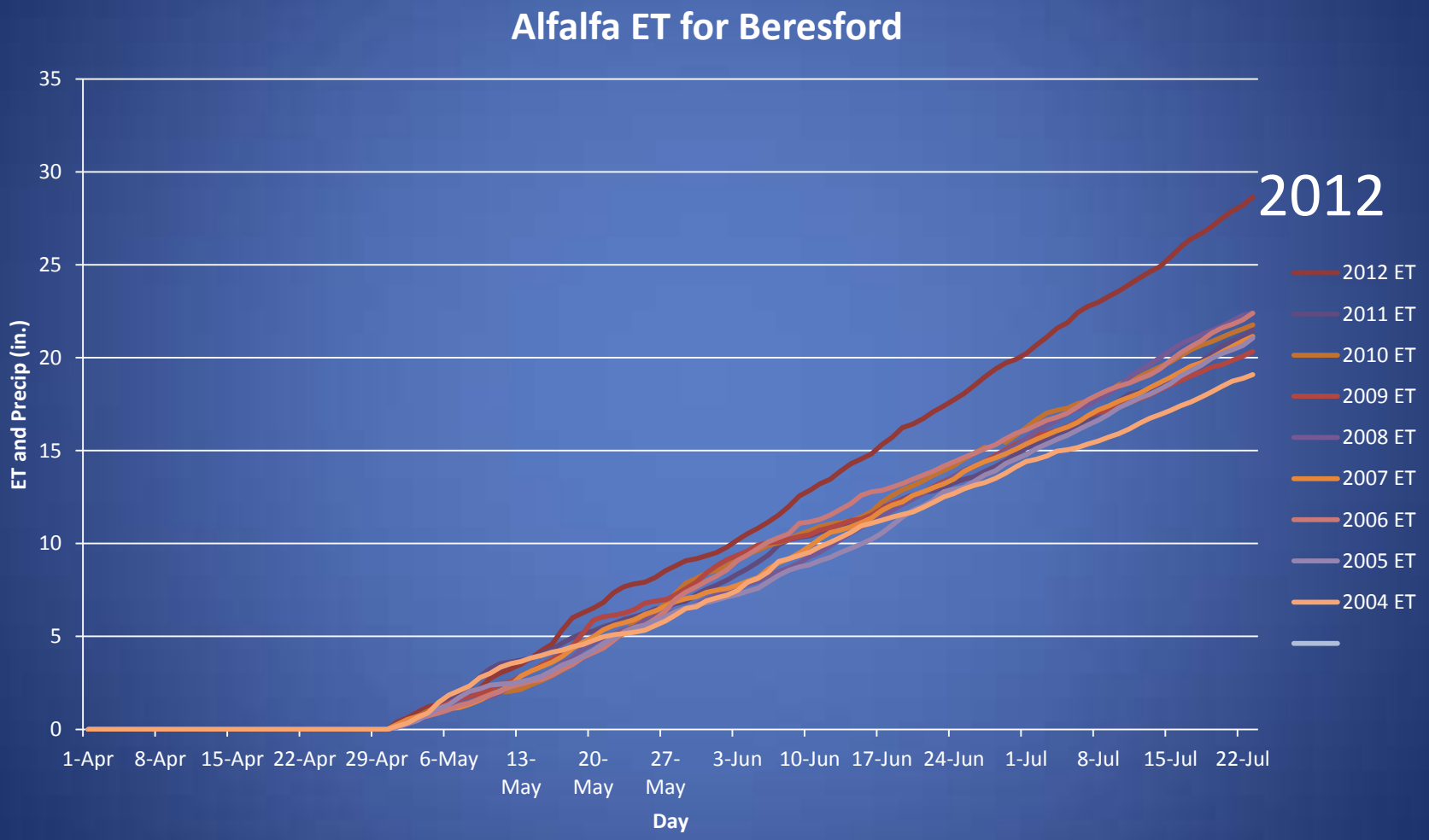
October snow/rains

Political carry-overs……


June-August 2012 Statewide Ranks
National Climatic Data Center/NESDIS/NOAA
Precipitation
1 = Driest
118 = Wettest
Record Driest
Much Below Normal
Below Normal
Near Normal
Above Normal
Much Above Normal
Record Wettest
NOAA



Atmospheric Demand



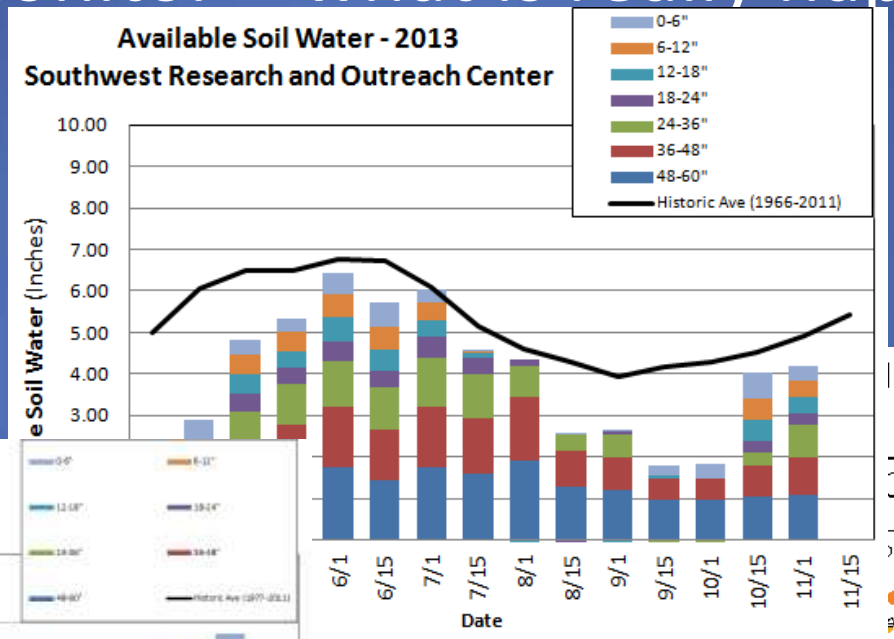
How do we use soil moisture?

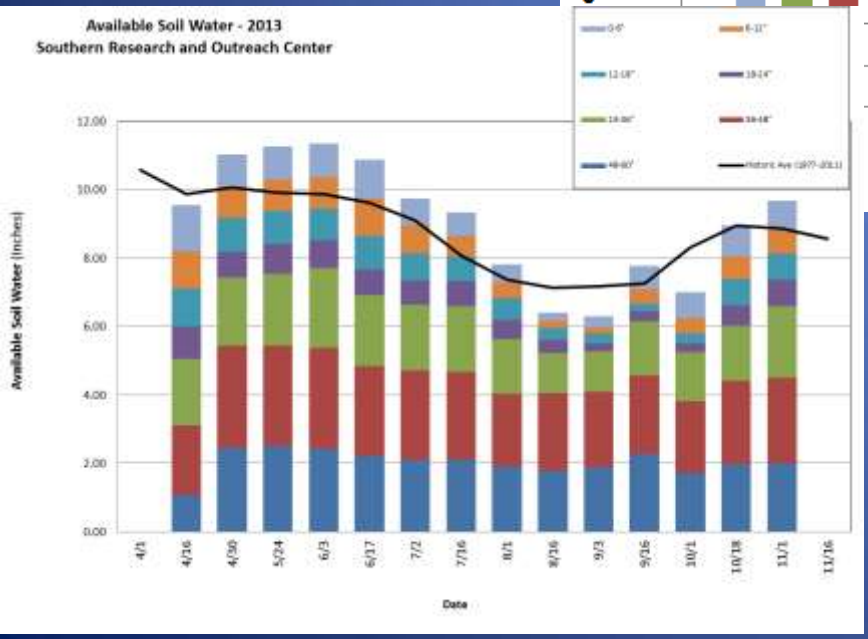
- Agriculture
  - Fall soil moisture recharge (limited or excess?)
  - Planting in the spring
  - Crop insurance – were soils too wet to plant?
  - Is there a time soil moisture is limited (crop stress/yield loss)?
  - Crop water use/irrigation
  - Field work timing/soil compaction

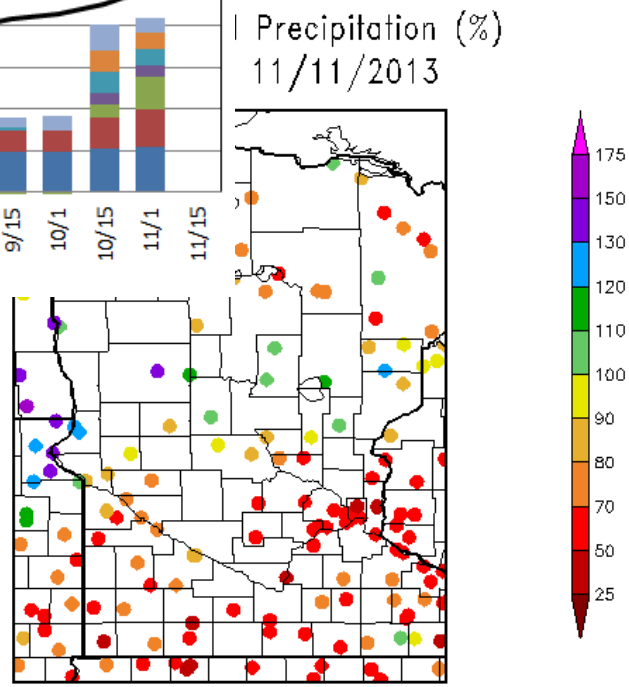
- Thanks to Jim Angel

How do we use soil moisture?

- Drought monitor – what is really happening in the soil?







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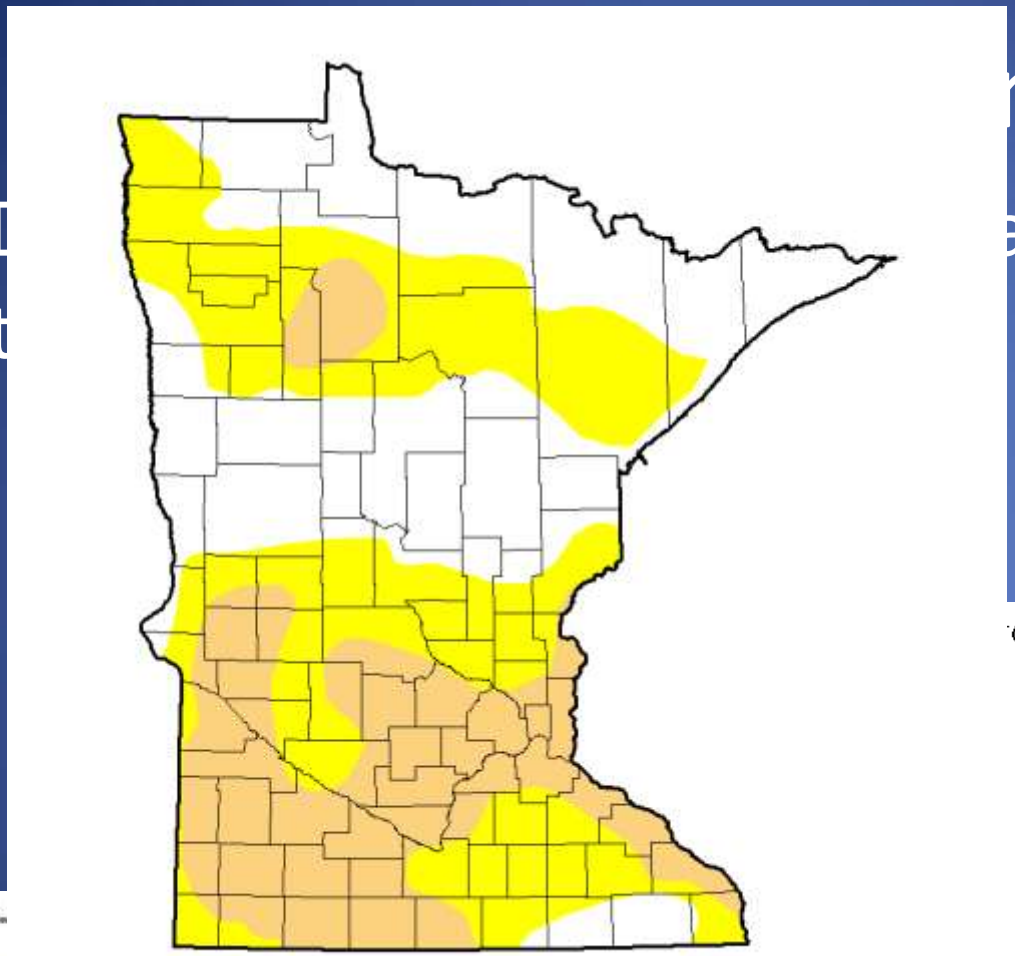
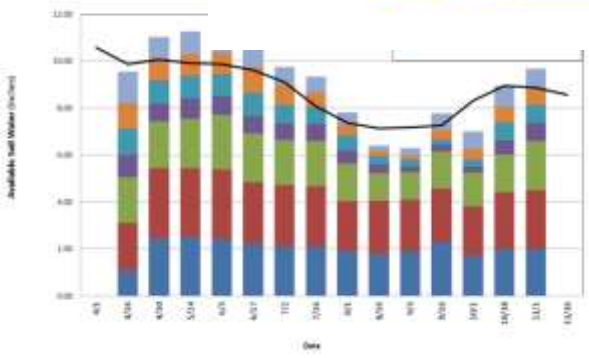
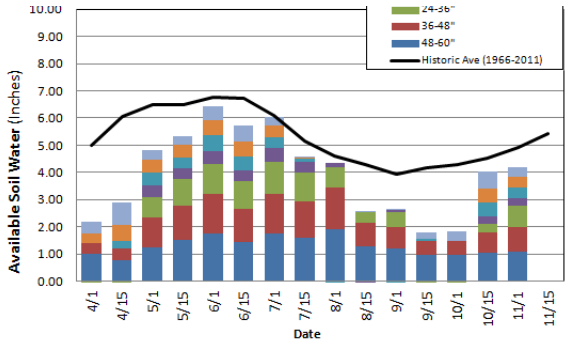
Regional Climate Centers

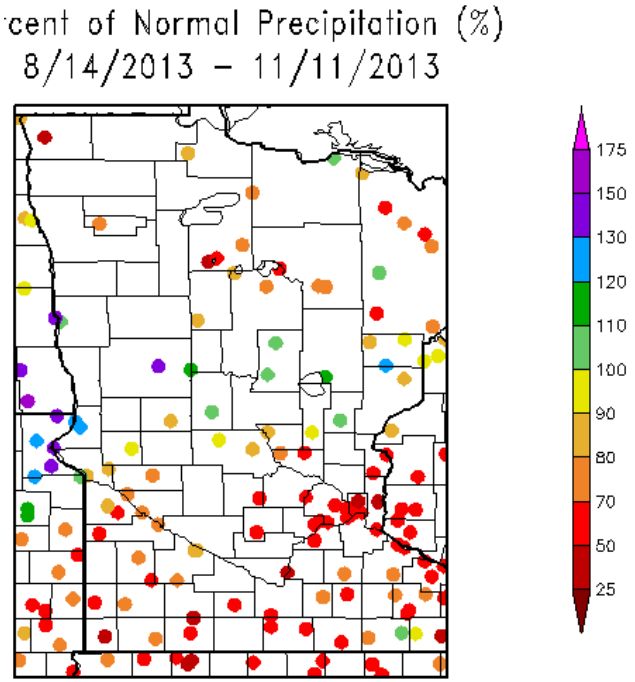
moisture?

- D ally happening in t









at HPRCC using provisional data.

Regional Climate Centers

How do we use soil moisture?

- Water
  - Multiple issues in determining run-off
  - Streams/lakes, etc.
  - Dug-out refill

  - Soil moisture recharge from a single storm event.

How do we use soil moisture?

- Other
  - Soil moisture impact on various pests
  - Freeze thaw cycles soil/road
  - How quickly will soil warm and cool?
  - Temperature/moisture and storm initiation

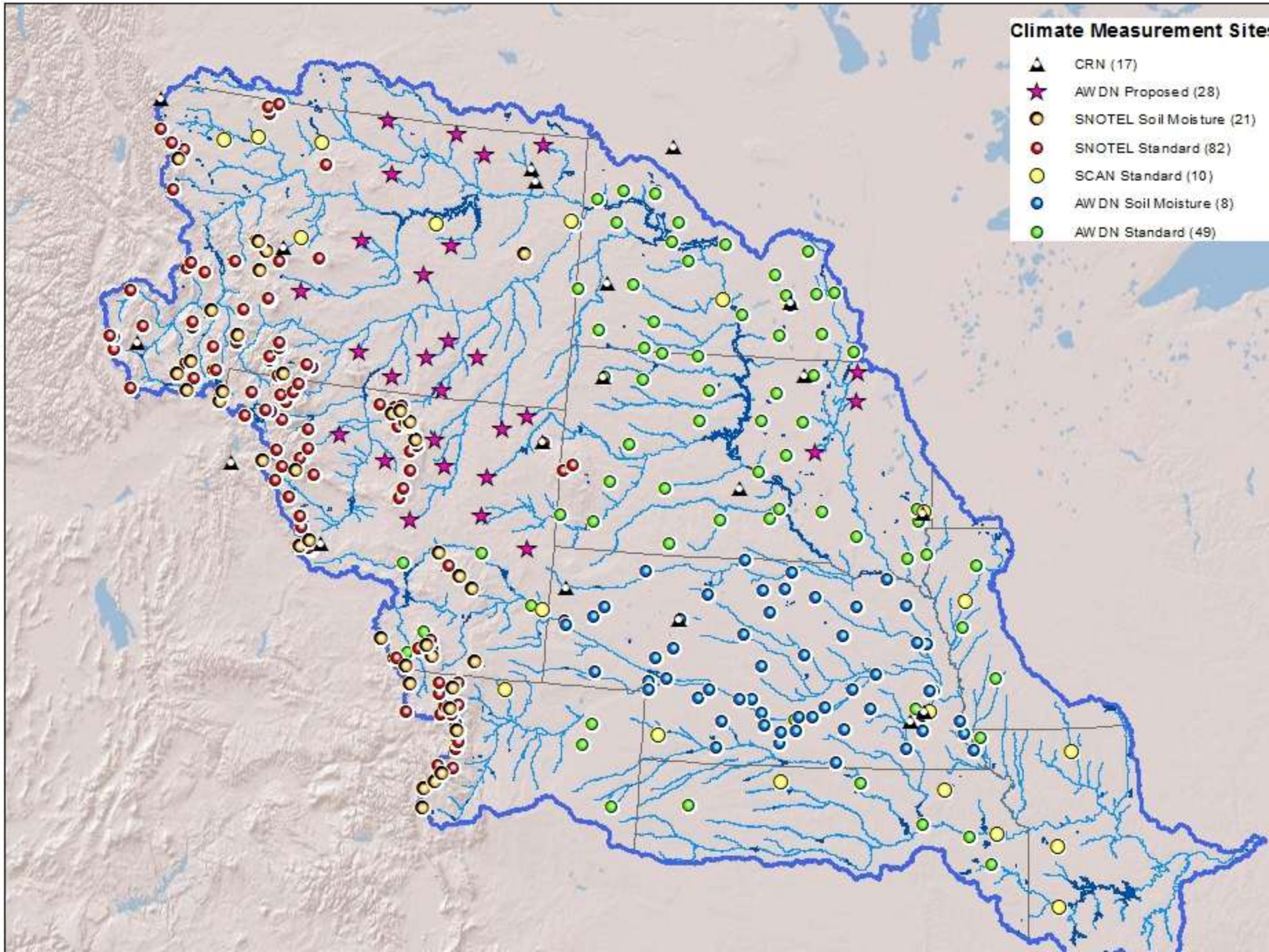
Missouri River Monitoring Study

- Recommendation – Improve Soil moisture and snow pack monitoring in the Plains
- Subsequent drought in 2012
- How could this be done?
- How much would it cost?

- Meeting in Bismarck fall of 2012 – various Missouri River partners in monitoring

Missouri River Monitoring Study

- Developed a scoping document and cost proposal
- Price tag $6M initial w/$1.6M/year ongoing
  - NOAA
  - USGS
  - USDA-NRCS
  - SD/ND SCOs
  - HPRCC


Climate Measurement Sites
CRN (17)
AWDN Proposed (28)
SNOTEL Soil Moisture (21)
SNOTEL Standard (82)
SCAN Standard (10)
AWDN Soil Moisture (8)
AWDN Standard (49)

Missouri River Monitoring Study

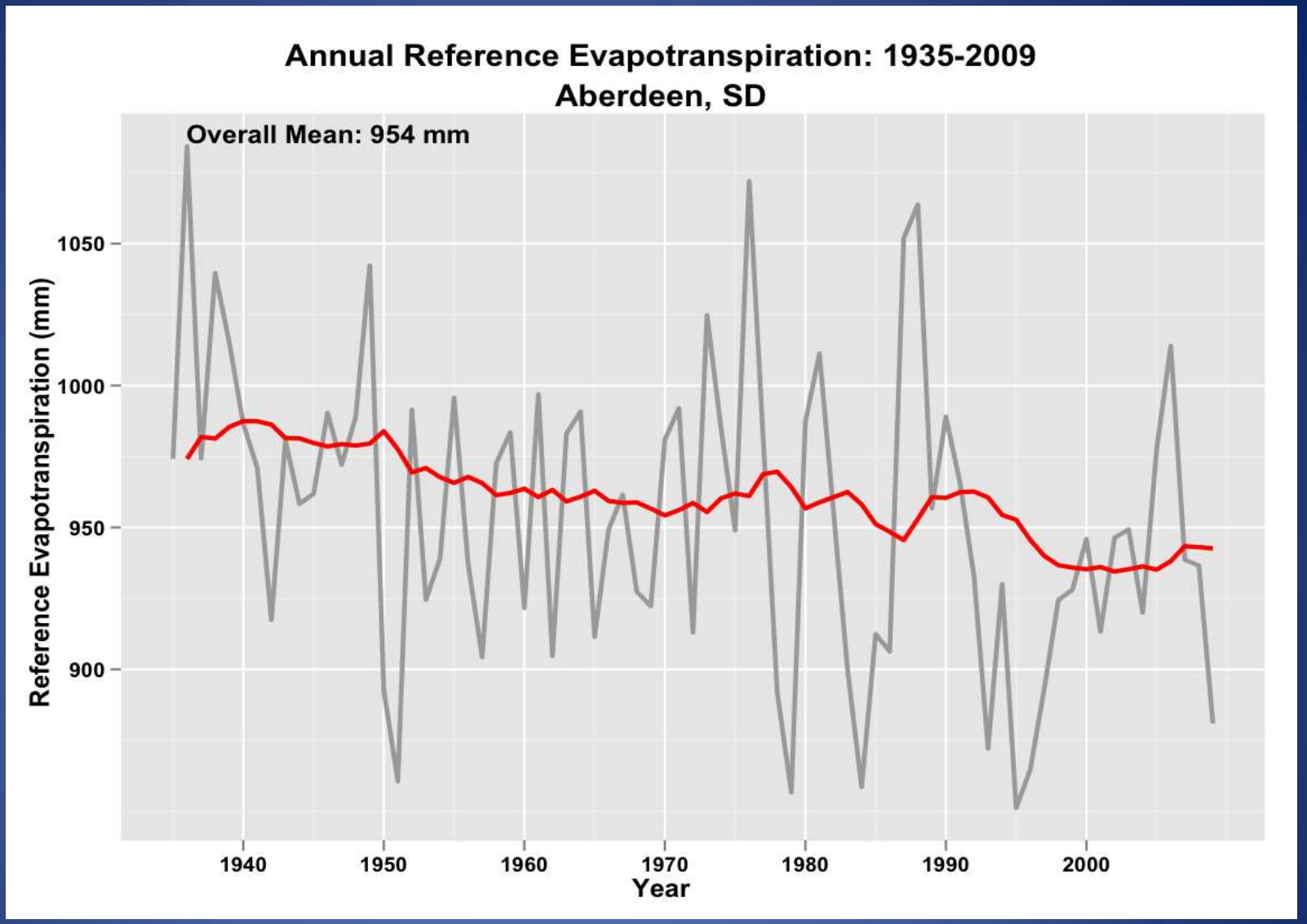
- Add stations to holes in network – gap analysis
- Add soil moisture to existing network stations
- Coordinate volunteer snow monitoring – Plains
- Work with NOAA on snow monitoring modeling – flight lines

Missouri River Monitoring Study

- Improve assessment of water in the basin (soil moisture and on-ground
- Real-time consistent monitoring
- Advance notice of flooding issues

- Better drought assessment potential

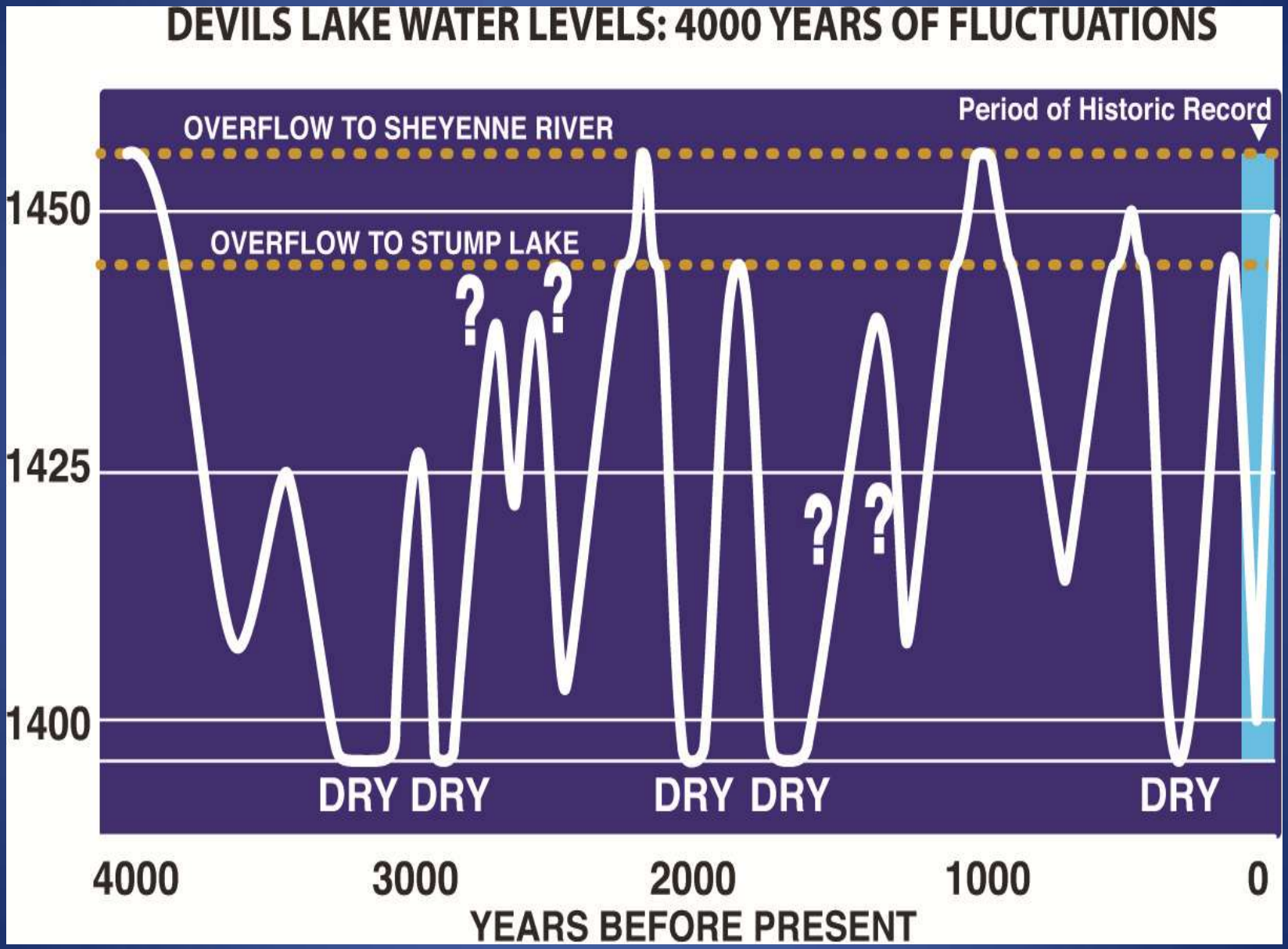
- Currently sitting in a bill in DC waiting to go to committee



ET – Evapotranspiration, a combination of surface evaporation and transpiration from a crop

Calculated based on temperature index

South Dakota has a smaller version at Waubay



Other information

- Increasing interest in tiling – SDSU, NDSU and UM and cooperative extension doing programming
- Enlarging lakes/sloughs
- Soil moisture information would be helpful – need to develop more capability for this
- Leading to prevent plant issues - RMA

Other issues (obvious or not)

- Similar standards – can’t do the same everywhere
- Surface conditions
- Station density
- Others

Comments/Questions/Complaints?

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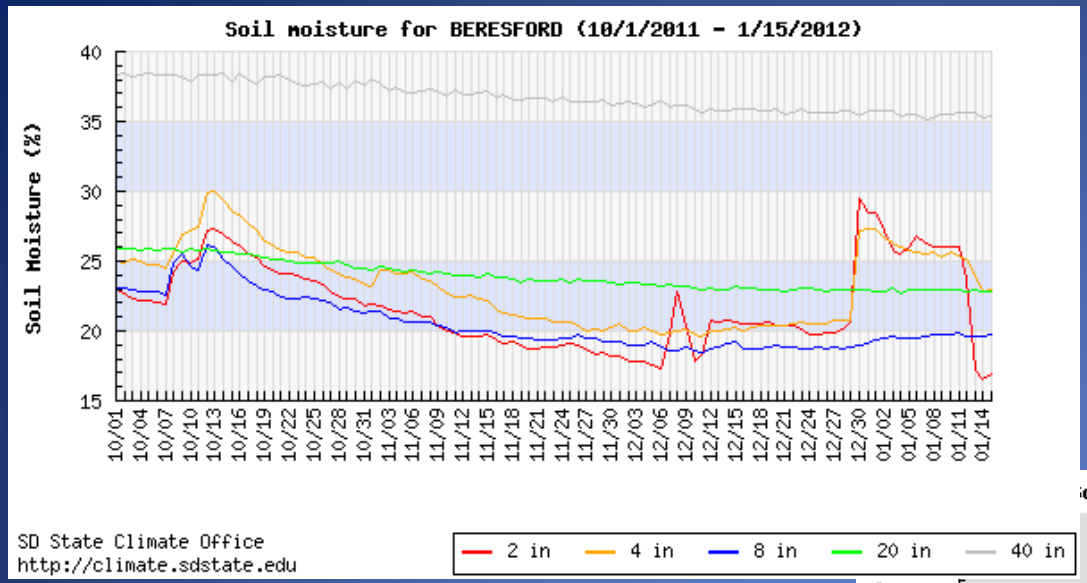
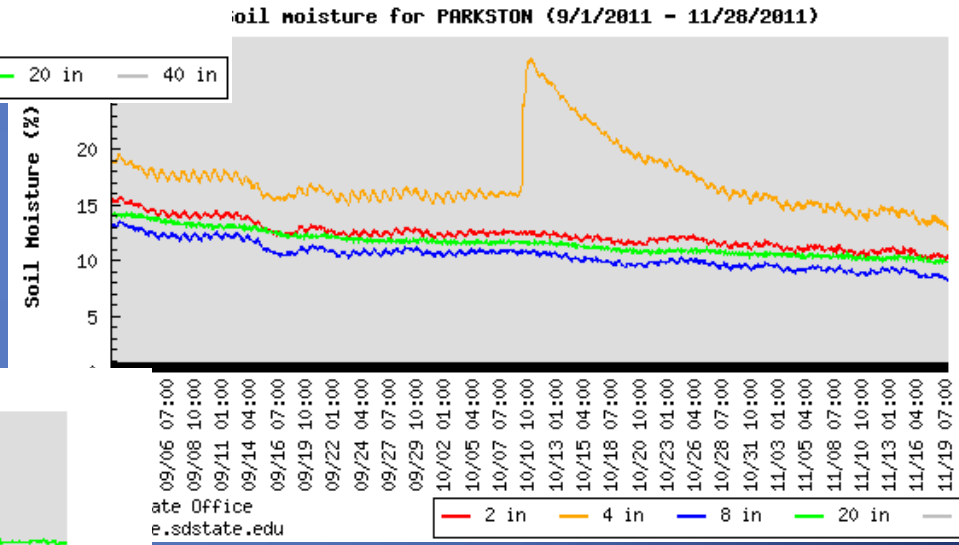
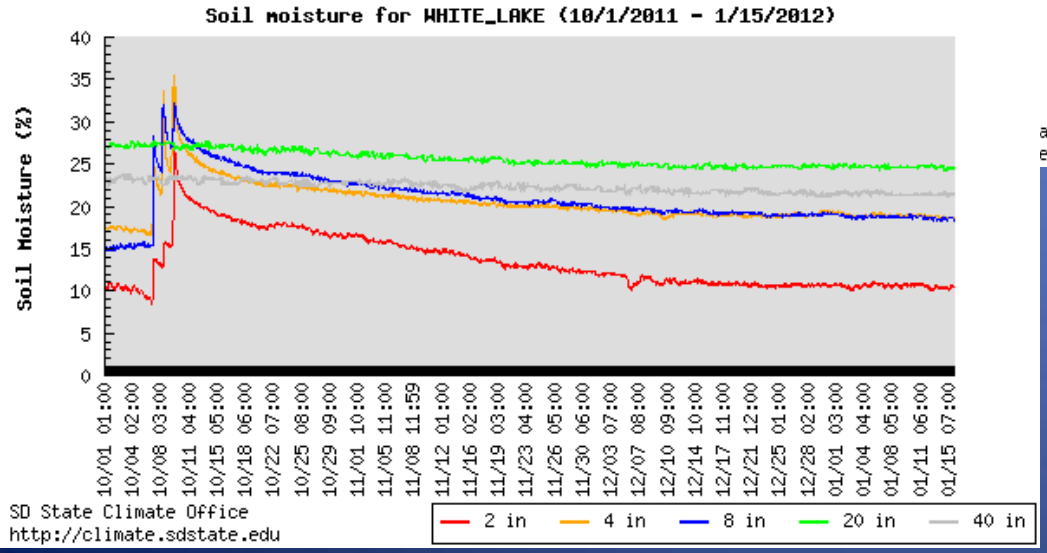
SOUTH DAKOTA Climate and Weather


Soil moisture for BERESFORD (10/1/2011 - 1/15/2012)
Soil Moisture (%)
SD State Climate Office
http://climate.sdstate.edu
2 in
4 in
8 in
20 in
40 in


oil moisture for PARKSTON (9/1/2011 - 11/28/2011)
Soil Moisture (%)
ate Office
e.sdstate.edu
2 in
4 in
8 in
20 in
40 in


Soil moisture for WHITE_LAKE (10/1/2011 - 1/15/2012)
Soil Moisture (%)
SD State Climate Office
http://climate.sdstate.edu
2 in
4 in
8 in
20 in
40 in